PRECISION JOINING CENTER

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ABSTRACT

EG&G Rocky Flats and the American Welding Society (AWS) are proposing to establish a Precision Joining Center (PJC). The PJC will be a cooperatively operated center with participation from EG&G Rocky Flats, AWS, the Department of Energy (DOE) Nuclear Weapons Complex (NWC), the Colorado School of Mines, and U.S. private industry. The PJC's primary mission will be as a training center for advanced joining technologies. This will accomplish several objectives: 1) It will provide an effective mechanism to transfer joining technology from the NWC to private industry; 2) It will provide a center for testing new joining processes for the NWC and private industry ; 3) It will provide highly trained personnel to support advanced joining processes for the NWC and private industry.

INTRODUCTION

A study began at the Rocky Flats Plant in the fall of 1989 to evaluate forming a U.S. Center of Excellence (COE) in the field of joining technology. To accomplish this, the study evaluated U.S. and European welding institutes for operating structures and research and development emphasis. In addition, other Department of Energy (DOE) technology transfer programs were evaluated and noted for their successes and failures. The area of need that has emerged from this study was that of training in precision joining processes. From this has come the concept of a Precision Joining Center, with its primary mission to be a training center for high level technicians (i.e. technologists) in the use of precision joining processes.

The American Welding Society has concurred with this material need and has joined in the work of establishing this center. The Precision Joining Center will be a cooperative effort between EG&G Rocky Flats, the American Welding Society, the DOE Weapons Complex, and U.S. private industry. The center will, by the means of training, accomplish several objectives: 1) It will provide an effective means of technology transfer in precision joining methods from the DOE complex to U.S. private industry, 2) In the reverse case, the center will provide a testing ground for new technology for DOE complex modernization; 3) The center will fill the education gap between existing vocational schools and engineering colleges; 4) The center will be a resource for small to medium sized industrial companies for precision joining processes.

PROPOSED STRUCTURE

The structuring of the Precision Joining Center has several important considerations.

Curriculum

The first consideration is the curriculum. The curriculum will be established by industrial input to keep it current with the on-going needs of industry. The initial curriculum outlined in this article is a result of an industrial workshop held for the purpose of its development. The established curriculum will be continually updated to meet new needs through customer contacts.

Course Structure

For the center to operate successfully with industry, the time and financial impact on participating companies must be minimized. This will be accomplished by making the core courses of the program portable so that they can be taught at any location. The class starting times will be flexible. This will reduce travel expenses and time away from the job for the students participating in the program.

The hands-on training will be accomplished at the center and will require travel by the participating student.

Equipment

For an advanced joining center to be effective, it must be equipped with state-of- the- art equipment. To accomplish this, manufacturers will be asked to participate by consignment of advanced joining equipment. Then, as equipment needs to be updated, the older machines will be returned to the suppliers as the new models are installed. The advantage for the suppliers will be first hand experience on their machines by potential future customers.

Staffing

Staffing for the center will come from the U.S. joining community based on minimum qualifications. However, staffing for the Precision Joining Center facility will be assured by EG&G Rocky Flats, and the staffing for core courses taught off-site will be assured by the American Welding Society.

Scope of Training

The scope of training will be interdisciplinary and will include the following subject matter:

- Joining Technology
- Vacuum Technology
- Power Systems
- Data Acquisition
- Servo-Mechanisms and Robotics
- Computer Controls
- Record Keeping and Palentability
- Weld Defects and Inspection
- Metallurgical Considerations
- Heat Flow Considerations
- Fixtures and Tools
- Metrology
- Health, Safety, and Environment

The Welding Technologist

The curriculum will be designed to train hands-on technologists. These are the people that companies presently develop over several years of on-the-job experiences. They are the people who understand equipment, processes, and how to get projects done. This program will be designed to create these individuals faster, with fewer deficiencies in their training, and with a broader range of joining knowledge and experience.

Entrance Requirements

With the above objectives in mind, there will be minimum requirements for entrance into the program. These requirements are as follows:

- A graduate of a trade school, community college or equivalent.
- Or a minimum of three (3) years of technical experience.
- Plus recommendations

Graduate Profile

The training program objective will be to produce graduates with the following profile:

- Proven ability to:
  - Operate advanced welding/joining equipment
  - Communicate effectively with engineers, welders, and managers
  - Understand and direct welding and support processes
  - Perform joining R&D with minimal oversight
- Documentation Skills
- Analytical Skills
- Measurement Skills

The Curriculum

The curriculum will be divided into two major segments. The first segment will be composed of eight one-week core courses. These courses will be taught at off-site locations and at the Precision Joining Center. It is anticipated that most students would attend the core courses at a location in or near to their normal workplace. The second segment will be composed of three two-week courses taught at the Center. These courses will include considerable hands-on experience with state-of-the-art joining equipment.

Core Courses

The core courses will be as follows:

1. Precision Process Controls and Metrology

2. Welding Process Selection

3. Elements of Welding Metallurgy

4a. Fusion Welding Parameters and Fusion Zone Profiles

4b. Solid State Bonding and Brazing Processes

5. Weld Properties, Design, and Defects

6. Weld Testing and Defect Detection

7. Weld Parameter Development and Statistical Process Control

8. Welding Problem Analysis and Technical Communications

Joining Process Courses

These courses are hands-on courses designed to give the student practical experience with process control and design. The process course will be subdivided into three categories: arc processes, beam processes, and non-fusion processes. Each of these categories will have three two-week sessions of classroom and laboratory work. These hands-on sessions will cover a variety of topics including the following:

- Process variables and Controls
- Interactive Control Systems
- Computerized Joining Systems
- Data Acquisition
- Support Systems
  - Basic Electronics
  - Vacuum Systems
  - Power Systems
  - Servo Mechanisms
- Tooling and Fixturing
- Application of QA Concepts

Certification

As a student progresses through the program permanent records will be maintained. In addition, a Continuing Educational Unit will be given for each successfully completed course. After completion of the program, the student will receive a certification of completion. His records will be accessible through the Precision Joining Center registrar.

SUMMARY

The establishment of the Precision Joining Center will meet several current U.S. industrial needs. It will provide a mechanism to transfer joining technology between the NWC and private industry. It will help meet the need for trained joining technologists to operate industrial precision joining processes. And, it will provide a resource for small and medium size companies in advanced joining systems.